**Supplementary files**

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| Supplementary File 1a. Results from the final models for the reproductive success of beetles, blowflies, and mites in the field experiment. The final models used were: glmer.nb(Number of larvae ~ Mite treatment\*(poly(temperature,degree=2)[,2]+ poly(temperature,degree=2)[,1])+Carcass mass+(1|site)+(1|year)). Models analyzing burying beetle larvae and blowfly larvae were both sufficient to reject the null hypotheses, with 81.3% and 98.6% power, respectively, whereas the model analyzing mite offspring was not, with a power of 36.9%. |
| **Dependent variables** | **Explanatory variables** | ***X2*** | **d.f.** | **p** |
| Number of beetle larvae | Mite treatment | 3.46 | 2 | 0.177 |
|  | Temperature | 0.25 | 1 | 0.616 |
|  | Temperature2 | **11.50** | **1** | **<0.001** |
|  | Carcass mass | 0.01 | 1 | 0.913 |
|  | Mite treatment \* temperature | 0.67 | 2 | 0.716 |
|  | Mite treatment \* temperature2 | **10.81** | **2** | **0.004** |
| Number of blowfly larvae | Mite treatment | **9.31** | **2** | **0.010** |
|  | Temperature | **5.09** | **1** | **0.024** |
|  | Temperature2 | **13.50** | **1** | **<0.001** |
|  | Carcass mass | **11.86** | **1** | **<0.001** |
|  | Mite treatment \* temperature | 3.69 | 2 | 0.158 |
|  | Mite treatment \* temperature2 | **11.53** | **2** | **0.003** |
| Number of mite offspring | Mite treatment | 0.08 | 1 | 0.778 |
|  | Temperature | 2.63 | 1 | 0.105 |
|  | Temperature2 | 1.07 | 1 | 0.300 |
|  | Carcass mass | 3.25 | 1 | 0.071 |
|  | Mite treatment \* temperature | 0.02 | 1 | 0.877 |
|   | Mite treatment \* temperature2 | 0.03 | 1 | 0.863 |
| p values < 0.05 are statistically significant, in bold |  |  |  |

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| Supplementary File 1b. Results from the final models for the reproductive success of beetles, blowflies, and mites in the Laboratory experiment 1. For beetles, the final model used was: glmer.nb(Number of larvae ~ Mite treatment\*Temperature treatment\*Blowfly treatment+Carcass mass+(1|block)); for blowflies, the final model used was: glmer.nb(Number of larvae ~ Mite treatment\*Temperature treatment+Carcass mass+(1|block)); and for mites, the final model used was: glmer.nb(Number of larvae ~ Blowfly treatment\*Temperature treatment+Mite treatment+Carcass mass+(1|block)). All these models were sufficient to reject the null hypotheses, with the 97%, 97%, and 98.2% power, for analyses of burying beetle larvae, blowfly larvae, and mite offspring, respectively.  |
| **Dependent variables** | **Explanatory variables** | ***X2*** | **d.f.** | **p** |
| Number of beetle larvae |  |  |  |
| *Full model* | Mite treatment | 2.46 | 2 | 0.293 |
|  | Temperature treatment | 2.66 | 2 | 0.265 |
|  | Blowfly treatment | **27.22** | **1** | **<0.001** |
|  | Carcass mass | **10.02** | **1** | **0.002** |
|  | Mite treatment \* temperature treatment | 1.54 | 4 | 0.819 |
|  | Mite treatment \* blowfly treatment | **10.27** | **2** | **0.006** |
|  | Temperature treatment \* blowfly treatment | **15.54** | **2** | **<0.001** |
|  | Mite treatment \* temperature treatment \* blowfly treatment | **10.33** | **4** | **0.035** |
| *Without blowflies* | Mite treatment | **10.60** | **2** | **0.005** |
|  | Temperature treatment | 4.09 | 2 | 0.129 |
|  | Carcass mass | **15.43** | **1** | **<0.001** |
| *With blowflies* | Mite treatment | 5.85 | 2 | 0.054 |
|  | Temperature treatment | **18.73** | **2** | **<0.001** |
|  | Carcass mass | 2.36 | 1 | 0.125 |
|  | Mite treatment \* temperature treatment | **11.39** | **4** | **0.023** |
| Number of blowfly larvae | Mite treatment | **8.83** | **2** | **0.012** |
|  | Temperature treatment | **34.05** | **2** | **<0.001** |
|  | Carcass mass | **4.36** | **1** | **0.037** |
|  | Mite treatment \* temperature treatment | **14.33** | **4** | **0.006** |
| Number of mite offspring | Mite treatment | **12.60** | **1** | **<0.001** |
|  | Temperature treatment | **10.12** | **2** | **0.006** |
|  | Blowfly treatment | **10.85** | **1** | **<0.001** |
|  | Carcass mass | **4.41** | **1** | **0.036** |
|   | Blowfly treatment \* temperature treatment | 5.58 | 2 | 0.061 |
| p values < 0.05 are statistically significant, in bold |  |  |  |

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| Supplementary File 1c. Results from the final models for the development of blowfly larvae in the Laboratory experiment 2. For number of blowfly larvae, the final model used was: glm.nb(Number of larvae ~ Temperature treatment+Carcass mass+Blowfly egg mass); for carcass consumption rate, the final model used was: betareg(Consumption rate ~ Temperature treatment+Carcass mass+Blowfly egg mass); and for development rate, the final model used was: glmer(Days ~ Temperature treatment\*Developmental stage+Carcass mass+Blowfly egg mass+(1|carcass ID)). Models analyzing number of blowfly larvae and carcass consumption rate were both not sufficient to reject the null hypotheses, with 12.9% and 22.8% power, respectively, whereas the model analyzing development rate of blowfly larvae was highly sufficient, with a power of 100%. |
| **Dependent variables** | **Explanatory variables** | ***X2*** | **d.f.** | **p** |
| Number of blowfly larvae | Temperature treatment | 0.35 | 2 | 0.841 |
|  | Carcass mass | 0.64 | 1 | 0.423 |
|  | Blowfly egg mass | 1.25 | 1 | 0.263 |
| Carcass consumption rate | Temperature treatment | 2.57 | 2 | 0.277 |
|  | Carcass mass | 3.08 | 1 | 0.079 |
|  | Blowfly egg mass | 0.33 | 1 | 0.564 |
| Development rate of blowfly larvae | Temperature treatment | **19.06** | **2** | **<0.001** |
|  | Developmental stage | **405.39** | **4** | **<0.001** |
|  | Carcass mass | 0.12 | 1 | 0.731 |
|  | Blowfly egg mass | 3.25 | 1 | 0.072 |
|   | Temperature treatment \* Developmental stage | **178.46** | **8** | **<0.001** |
| p values < 0.05 are statistically significant, in bold |  |  |  |

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| Supplementary File 1d. Results from the final models for beetle's carcass preparation in the Laboratory experiment 3. For number of blowfly larvae, the final model used was: glm.nb(Number of larvae ~ Temperature treatment+Carcass mass+Blowfly egg mass); and for carcass roundness, the final model used was: glm.nb(Roundness ~ Temperature treatment+Carcass mass+Blowfly egg mass). Models analyzing number of blowfly larvae and carcass roundness were both sufficient to reject the null hypotheses, with 96.4% and 99.5% power, respectively. |
| **Dependent variables** | **Explanatory variables** | ***X2*** | **d.f.** | **p** |
| Number of blowfly larvae | Temperature treatment | **14.08** | **2** | **<0.001** |
|  | Carcass mass | 0.42 | 1 | 0.516 |
|  | Blowfly egg mass | 3.77 | 1 | 0.052 |
| Carcass roundness | Temperature treatment | **30.30** | **2** | **<0.001** |
|  | Carcass mass | 2.16 | 1 | 0.142 |
|  | Blowfly egg mass | 2.61 | 1 | 0.106 |
| p values < 0.05 are statistically significant, in bold |  |  |  |